

THE BROAD STREET PUMP:
AN EPISODE IN THE CHOLERA EPIDEMIC OF 1854.

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14.

EARLY on the morning of September 1st, 1854, in the Berwick Street district of St. James's, Westminster, where I had spent some hours of the preceding day without hearing any mention of cholera—and where, in former epidemics, the mortality from that disease had been inconsiderable—I was asked to visit a house in which lay, already collapsed, four persons who had been seized with cholera during the night; and, on leaving this house, whichever way I turned, I came upon similar scenes. At noon, when I met my brother curate and the Scripture-reader for a short time in the vestry of St. Luke's, Berwick Street, I learned that they had each been occupied all the morning in the same way as myself. The rest of the day was spent in the same manner; and, as an indication of the severity of the outbreak, I record that, of all the cholera patients visited by me on that day, only one recovered.

This state of things apparently continued for four days, during which time the medical men of the neighbourhood—whose labours day and night in behalf of the sufferers were beyond all praise—declared, with one consent, that specific remedies were unavailing; and as for “premonitory symptoms,” there were, they said, few, or even in some cases none at all.

On the fifth day we were all agreed that a change for the better had taken place, as we perceived that fewer persons were attacked than at first, and that the attacks were less severe. This change, however, was subsequently seen, when the statistics of the outbreak were collected and examined, to have been more gradual, and to have begun at an earlier period, than we had supposed; for, though the *deaths* were as numerous

on the 3d and 4th of September as on the 1st, yet the greatest number of fatal *attacks* occurred on the 1st, after which there were fewer fatal attacks on each succeeding day, the number positively decreasing 50 per cent. on the 3d as compared with the 2d, and 10 per cent. on the 2d as compared with the 1st. Perhaps the most fatal period of attack was the hour or two before midnight on August 31st. The deaths were the most numerous on September 2d, the excess of mortality on that day being due to attacks of the previous day. By the 10th the number of fatal attacks throughout the whole parish of St. James's had declined to the low average of the preceding month.

But during those ten days the ravages of the disease, in a small and remarkably well-defined part of the parish, were very severe—nearly 700 persons having been fatally seized, in that short time, within a circuit of 250 yards radius from the point of junction between Broad Street and Cambridge Street. Such was the intensity of the outbreak, that of 45 contiguous houses, extending in different directions from that point, only 4 escaped without a death; and at an average distance of 15 yards from St. Luke's church, situated within the compass of the said radius, were 4 houses which collectively lost 33 inhabitants. Of the streets thus devastated Broad Street itself suffered the most severely, its population having been just decimated—90 of its 896 inhabitants having died, besides 28 non-resident workpeople. Other streets, however, had nearly as high a rate of mortality.

Thus limited in its extent, brief in its duration, and continually on the wane from the very first moment of

its appearance, was this great outbreak—the like of which had, perhaps, never before been seen in this country.

Of course, as soon as it began to subside, leaving us time for reflection and discussion, we indulged in speculation respecting its origin; but none of us could advance a satisfactory hypothesis, for the simple reason that its facts seemed to contradict all the then prevalent theories concerning the spread of cholera.

For my own part, a number of notions which I had been accustomed to hold as indisputable appeared to be no longer tenable. Especially I found myself rebelling against the celebrated dictum that, “whilst pestilence slays its thousands, fear slays its tens of thousands;” which saying, having seen the brave and the timid indiscriminately dying and indiscriminately surviving, I had come to regard as an insult to the memory of the dead, many of whom had behaved most heroically; and the more I considered the dictum the more I disliked it, and thought it a mischievous notion. That such fear as deserves the name of cowardice is a bad thing at any time and under any circumstances; that for many reasons it is a very bad thing on the eve of unusual peril; that, in prospect of cholera, by leading to the suppression of useful information which might suggest means of prevention or escape, it may indirectly even slay its tens of thousands—is most true. But surely there can be no more effectual method of aggravating it than by asserting that fear is a powerful predisposing cause of cholera. A man who is afraid at all becomes ten times more afraid when he believes that his fear positively invites the disease; for is it not as certain a principle as any in the philosophy of the human heart that fear is the least voluntary, the least controllable, of its affections? There is need, therefore, even on the ground of expediency, of a protest against the teaching of those who contrive to frighten while they believe they are encouraging each other by fostering a notion which can only augment the apprehension which even the brave may, without discredit, entertain and avow concerning a mysterious

danger. But, apart from all question of expediency, is this notion true? In St. James’s Workhouse, situated within the fatal area, and filled with the old, the infirm, and the idle, the very class of persons likely to be afraid, the deaths in 1854 were only 1 per cent. of the inmates, instead of 10 per cent. as in the neighbouring streets. “Weren’t you afraid,” I asked of one old man in the workhouse, “when they brought in so many dead and dying?” “We just were,” he said. And well they might be, for on one night there were as many as 80 bodies in the dead-house.

“Yes, but the workhouse was at least kept clean,” some will say. Very likely. And this leads me to say that outside of the workhouse the clean and the dirty, like the brave and the timid, fared alike in death or escape. Three houses which had been singled out by the parochial authorities, during an inspection of the parish, for special commendation in the matter of cleanliness, were almost the only houses in one particular street which were visited by the disease,—one of them losing 12 of its inmates. On the other hand, the very filthiest house in the district was one of the only four houses already mentioned as having among 45 contiguous houses escaped without death; whilst, within a few yards of this house, a model lodging-house lost 2 of its inmates. As a matter of fact, from intimate knowledge of the district and its inhabitants, I affirm that want of cleanliness was by no means more characteristic of the deceased than of the survivors.

Again, there was no ground in this outbreak for saying that the intemperate suffered more than the temperate, the poor than the rich, the weak than the strong. In short, those best acquainted with the district were altogether unable for a time to trace any connexion between the disease and the habits or circumstances of the persons whom it attacked. It apparently seized alike and spared alike persons of all habits and of all circumstances.

The district itself resembles surrounding districts which escaped, whilst it

might be favourably contrasted in sanitary matters with other parts of London which were lightly visited. Its level, too, is comparatively high, in which respect it presents an exception to a supposed law which had previously seemed to operate in connecting cholera more especially with the lower levels of London.

All this may at first sight appear very unsatisfactory; and so it appeared at the time to such of us as cared to speculate as to the origin of the outbreak. Nevertheless we were not without hope that its remarkable character would render its determining cause somewhat easy of detection. We had observed that its limits in every direction were most sharply defined, that those limits lay within a narrow compass, and that the beginning of the outbreak was very clearly marked in point of time. There had been scattered cases of cholera throughout the parish before September; but it was evident that something new and distinct suddenly came into operation on the last night in August. What that was we trusted might eventually be ascertained.

It was therefore with great satisfaction that we heard that, on the motion of Dr. Lankester, a committee had been appointed by the Vestry of St. James's to inquire into all the circumstances of the case. Vestries have a bad character with sanitary reformers. But, whatever ground there may be for the imputation cast upon other vestries, it is but an act of bare justice to say that, as far as my experience goes, the St. James's Vestry must stand exempted from the general condemnation. Of course there were some of the vestrymen who deprecated inquiry as likely to be "detrimental to the reputation of the parish;" but the majority persisted in going through with it, thus manifesting the same spirit which had formerly induced them to institute an elaborate investigation into the sanitary state of the parish, the failure of which to secure immunity from pestilence only shows, as will presently appear, how very minute such investigations ought to be.

The Cholera Inquiry Committee was eventually composed of eight vestrymen, six medical men, and one other clergyman besides myself; and, after long and laborious examination of every circumstance which could possibly throw light on the subject of our inquiry, a report, drawn up by Mr. J. Marshall, then assistant-surgeon and now surgeon of University Hospital, was presented to the Vestry,—which report, if it could have been widely circulated, would have rendered it wholly unnecessary for me to write another line upon the matter to which it relates.

In this investigation, whilst we did not overlook such general conditions as might have operated in producing a widely-spread epidemic, we yet felt that they must have required some special or local conditions to intensify its influence within the small compass which demanded our more immediate attention. Every local condition, therefore, of the infected district, such as elevation of site, nature of soil and subsoil, surface and ground plan, streets and courts, density and character of population, internal economy of houses, cesspools, house-drains, and sewerage, was minutely investigated. But, though we found much to lament or condemn in most of these particulars, we could not find in them any satisfactory explanation of the sharp line of demarcation which on every side surrounded what we termed the "cholera area" in the midst of a densely peopled neighbourhood; nor could we derive from them any theory which accounted for the apparent anomalies within the area itself.

It was, however, in these very anomalies that we found the clue which ultimately led us to a unanimous conclusion "that the sudden, severe, and "concentrated outbreak, beginning on "August 31st, and lasting for the few "first days of September, was in some "manner attributable to the use of the "impure water of the well in Broad "Street."

One member of the committee, the late Dr. Snow, even before the committee was formed, had propounded this

opinion, and indeed had prevailed upon the parish authorities to remove the handle of the pump on the 8th of September. But scarcely any one seriously believed in his theory. For my own part, when I first heard of it, I stated to a medical friend my belief that a careful investigation would refute it, alleging as one proof of its inaccuracy the fact of several recoveries from collapse having taken place, at least in spite of, if not actually by reason of, the constant use of the Broad Street water. I added that I knew the inhabitants of Broad Street so well, and had occasion almost daily to spend so much time among them, that I should have no great difficulty in making the necessary inquiries. Accordingly I began an inquiry, which ultimately became very elaborate; at an early stage of which, however, one day meeting the same friend, and being asked by him what way I had made towards clearing the character of the pump, I was obliged to confess that my opinion on that matter was less confident than when we had last talked about it. Soon after making this confession I received from Dr. Snow a copy of the second edition of his work on "The Mode of Communication of Cholera," in which I found an account of his researches into the supposed influence of the Broad Street well in producing the St. James's outbreak. I found, moreover, that he attributed this influence, not to general impurity in the water, but to special contamination of it from the evacuations of cholera patients, which he conjectured must have reached the well from the sewer or a cesspool. In thanking him for the book, whilst I could not help admitting the weight of many of his recorded facts, I still clung, as a last resource, to an *à priori* objection to his theory—urging that, if special contamination of the water in the way suggested had begun the mischief, the outbreak ought not so soon to have subsided, when much larger quantities of cholera excretions must have been continually pouring into the well through the same channel, whatever it might have been, of communication with the

sewers. As for cesspools, I at that time supposed they had mostly been abolished.

In the face, however, of these objections, the evidence implicating the pump kept on accumulating, not only in my hands, but also in those of other members of the committee, who were engaged in a similar inquiry, until at length sufficient evidence was collected to bring the whole committee to the unanimous verdict which they finally recorded.

I cannot, in the space now at my disposal, set forth this evidence in detail. But I will touch on its most salient points.

It appeared, then, according to a carefully-executed plan of the district, in which every house and every death was indicated, that the Broad Street public pump occupied a strikingly central position in the "cholera area;" that there was no other public pump within the area; and that, except in one direction, the mortality diminished almost to total disappearance on approaching decidedly nearer to any other pump. The exception was the neighbourhood of the pump in Little Marlborough Street, in which neighbourhood several deaths took place in Cross Street and Carnaby Street. But, as a matter of fact, the inhabitants of those streets did resort to the Broad Street pump, having, whether with or without reason, conceived a dislike to their own pump. A friend of mine, having more than once urged Cross Street as an obvious objection to the water hypothesis, went and made some inquiries in that street. When I next saw him he begged to withdraw his objection. Dr. Snow examined the cases of 48 persons who had died in houses nearer to other pumps than to that in Broad Street, and discovered that 28 had actually from preference drunk the Broad Street water shortly before being attacked, whilst there was a probability that 10 of the others also drank it. The details of this examination are given in the report.

Broad Street itself, as I have already said, suffered the most severely of all the streets: 90 of its 896 inhabitants died, besides 28 non-resident workpeople.

Of these 28 workpeople, seven belonged to a factory where the pump water was habitually used, whilst an adjoining factory, employing the same number of persons, where this water was never used, lost not a single "hand:" 18 others of the 28 worked at a factory situated close to the pump, from which water was daily fetched for the use of the workers; and these 18 were all fatally seized during the first two days of the outbreak, after which the factory was temporarily closed. On the other hand, not a single death occurred among the 70 men employed at a brewery on the same side of the street, of whom it was affirmed to be certain that none ever used the pump water, there being a deep well on the premises. With one exception, and that a house with only three inmates, the brewery (with its 70 men) was the only house free from death among the 22 houses (with their 67 deaths) on the south side of the street. An additional contrast to this remarkable exception was presented by the mortality among the labourers at work on an unfinished model lodging-house at the rear of the brewery, and separated from it only by a narrow court, 7 out of 35 men so employed having been fatally seized with cholera. The works were stopped on the third day of the outbreak; and it was ascertained that the Broad Street water had been in use among these men.

One half of Golden Square is within the limits of the cholera area, and yet entirely escaped; it is considerably nearer to two other pumps. On the other hand, St. Anne's Court, which lies just beyond the radius, and was heavily visited, is almost throughout its whole length nearer to the Broad Street pump than to any other.

St. James's Workhouse, not 150 yards from the centre of the area, surrounded on all sides by houses in which the deaths were numerous, and subject to the continual importation of the dying and the dead, lost only five of its 500 regular inmates, exactly the same number as in former visitations. The pump water was never used there.

Peter Street afforded, perhaps, as singular an instance as could be found of what is often termed the capriciousness or eccentricity of cholera; for, whereas there were 19 deaths in its smaller (western) portion, there was only 1 death in its much larger (eastern) portion. Now, the halting place of the pestilence, a house which lost 12 of its inhabitants, is only a few yards beyond the line of equidistance between the Broad Street and Rupert Street pumps, and the use of the Broad Street water in that house was ascertained to a certainty. The further one goes eastward from this house, of course the uncertainty as to the relative distances from the two pumps becomes less and less. But the one victim further east "fetched" in a large can of water from Broad Street on the 2nd of September, and "began drinking it freely."

One fact is most remarkable. A lady, residing at Hampstead (West End), being very partial to the Broad Street water, was in the habit of drinking it daily, having it fetched in a bottle by a cart that went every day from Broad Street to Hampstead. She was seized with cholera on September 1st, and died the next day. A lady staying with her at the time also drank of it and died. A servant drank the water, and had a slight attack of diarrhoea. No other case of cholera occurred at West End.

Dr. Snow ascertained that 61 out of 73 persons, registered as having died in the immediate neighbourhood of the Broad Street pump on the first two days of September, had been accustomed to drink the pump water either constantly or occasionally; whilst in 6 cases only was he informed that the deceased used not to drink this water, and concerning the remaining 6 he could learn nothing. The keeper of a coffee-shop, frequented by mechanics, where this water was supplied at dinner-time, told him on the 6th of September that she was already aware of nine of her customers who were dead. He also recorded the case of a gentleman who came from Brighton, on the 1st of September, to see his brother, who had been seized with

cholera. He found his brother dead, did not see the body, and, having taken some luncheon, with a small tumbler of brandy and water, the water being from Broad Street, left the house in twenty minutes. He died of cholera next day at Pentonville. In one street, assigned to Dr. Snow by the committee for special investigation, he found that, of its fourteen houses, the only four which escaped without a death were those in which the Broad Street water was never used, whereas it had been more or less used in the other ten.

The street assigned to me by the committee, though I more or less investigated every street in St. Luke's district, was Broad Street. Any one who has ever been engaged in a similar investigation will at once understand the peculiar advantages for such a purpose of a position which enabled me to choose my own time and opportunity for visiting each house. In most of the Broad Street houses, every floor, and in some every room, contained a separate family. It was, therefore, in many cases not enough to take the word of the ground-floor people with regard to the habits of a house. Each family had to be visited, and, as far as possible, each member of it to be conversed with. In order to accomplish this, it was necessary to visit the same house, and often the same family, several times. On the occasion of each visit, the people would, for the most part, as I had been with them during the outbreak, themselves turn the conversation to the cholera. I was thus able, without obtrusiveness, to examine and cross-examine them, and to check the evidence of one witness by that of another. In this way I collected a great number of facts concerning the habits both of the deceased and the survivors, making a point of letting scarcely a day pass without gaining some information, which I recorded, tabulated, and pondered over, every evening. If the street had not been deserted after the outbreak by more than half of its population, I should probably have learned something concerning the habits of almost every one of its 896 inhabi-

tants. As it was, I followed many of them to their new abodes, sometimes a long way off, and finally succeeded in obtaining more or less information respecting nearly 500 persons resident in Broad Street at the time of the pestilence. I then drew up a report, of which, omitting some points already brought forward, I here give Mr. Marshall's epitome:—

“It is shown by this evidence—1st. That of the 90 fatal attacks among the resident population of Broad Street, 84 took place between 31st August and 6th September; 56 between 31st August and 2d September; and 50 on September 1st and 2d. 2d. That of the 90 deceased persons, 45 positively drank the well-water shortly before illness; and that of only 13 altogether is it at all confidently said that they did not drink it. Moreover, that of the above-mentioned 84, the non-use of the water is asserted of only 8; and of the 56 persons attacked between 31st August and 2d September, it is positively affirmed of only 2 that they did not drink this water. 3rd. That undoubtedly, of 100 persons residing in Broad Street, who were attacked with cholera or diarrhoea (including dead and surviving), 80 drank the water, whilst 20 are affirmed not to have drunk it; whereas out of 336 persons living in that street, and who were not attacked with either disease, only 57 had drunk the water, whilst 279 had not. 4th. That there is a great probability that the numerical proportions were even more remarkable than this, all cases involved in any doubt having been rejected. (5th and 6th referred to the factories and brewery.) 7th. That, of 97 persons residing in 10 houses, in which no attack occurred, 87 did not drink the water at all, whilst the remainder did not drink it at the height of the outbreak, or drank it either in small quantities or mixed with spirits. 8th. That in a great number of particular instances, related at length, the evidence of an injurious influence exercised by the water becomes strengthened as the inquiry becomes more strict and search-

ing. 9th. That the want of good sanitary arrangements in certain houses operated by compelling the residents to resort to the pump for drinking-water; and that, on the contrary, in certain instances where the drains were in good order, the cisterns were clean, and the inhabitants did not send to the pump. 10th. That through the district generally the aged and infirm, when isolated, escaped, not merely because they had more house accommodation, but because they did not use the water, having no one to send for it."

In estimating the drift of the evidence, of which the above is only a brief abstract, particular attention must be paid to the statement that "of the 56 inhabitants of Broad Street fatally attacked between the 31st August and 2d September, it is positively affirmed of only 2 that they did not drink this water." Not that it is certain that the rest all *did* drink it; but that of only 2 was it said, with any degree of certainty, that they *did not*.

Before August 31st there had been three fatal attacks in this street, viz. one on the 12th, one on the 28th, and one on the 30th, which was about the proportion of cases that might be expected in such a street during an epidemic. Concerning the drinking of water in the first of these cases, I could learn nothing; but in the other two cases the non-use of the pump water was clearly established. The case on the 30th was that of a boy who had just come from Bayswater, and whose mother and sister also died of cholera at Bayswater. The case on the 28th is one which will presently assume some importance. But meanwhile I pass on to notice that, whilst of the 56 or (including work-people) 84 cases in Broad Street on August 31st and September 1st and 2d, it was only in 2 that the non-use of this water was positively affirmed, yet in the remaining 31 between September 2d and 9th, the non-use of it was as positively affirmed in 9 cases, 3 of which were the only cases that occurred after September 6th. After the 9th cholera and diarrhoea disappeared from the street.

Thus it appears that, whilst the influence of the well-water was paramount among the causes of cholera for three days, it is not traceable at all before those three days, and after them becomes less and less traceable day by day.

Now if cholera be, as seems now to be admitted, in some way communicable from one person to another, and if, to borrow a term from the cattle plague commissioners, there be a period of "incubation," the above facts may be accounted for, especially if there be reason to believe that the well-water soon but gradually became innocuous. Pending further explanation, presently to be given, I will state the case provisionally. During a cholera epidemic in a large city, for reasons which, as an investigator of the one determining cause of a concentrated outbreak, I need not be able to ascertain, any street is liable, as I have shown Broad Street to have been, to desultory inroads from cholera; and one patient may communicate the disease to other people who approach him, owing, on Dr. Snow's hypothesis, to their accidentally swallowing, in any of various conceivable ways, ever so minute a portion of his evacuations. In a well-regulated house, where the patient can be isolated, and where those who nurse him are careful to wash their hands, the risk of such an accident need not be very great. But when, as is too often the case, a whole family is huddled together to eat, drink, and sleep in a single room, with no great facilities for ablution, then the risk is great; which will account for all that is urged, and rightly urged, respecting the influence of bad sanitary arrangements upon the propagation of cholera. But it does not account for those startling outbreaks which indiscriminately strike down people of every class and condition. For such outbreaks there is required an agent which can freely convey the poison even into well-regulated houses. And in searching for this agent, we are reduced to decide between air and water. But the atmospheric theory always breaks down in

the "anomalies" and "eccentricities," whilst it is precisely in these circumstances that the water theory, with a proper investigation, generally acquires its greatest confirmation. If, then, the excretions of a cholera patient should find their way into a public well, tank, or spring, a sudden and severe local outbreak is the result. In a day or two the chances of swallowing the poison in other ways necessarily become multiplied. Thus, among the later cases in Broad Street, I found that 3 were those of women who had recently washed cholera linen. But with regard to these other modes of propagation of the disease, it is satisfactory to observe, from the experience of Broad Street, how limited, even under favouring circumstances, is the scope of their operation.

I have to state, with respect to the 10th clause of the above epitome, that the anomaly there explained was mentioned by me, without knowledge of its secondary cause, from St. Luke's pulpit on September 8th, when I congratulated the poor old women, who formed a considerable portion of the congregation, upon their remarkable immunity from the pestilence. At that time I had been too busy to meddle with hypotheses, and had not even heard of Dr. Snow's bill of indictment against the pump. The escape of these women, many of whom, living alone, had "no one to send" to the well, was one of those "eccentricities" which found their best explanation in the pump theory.

I should have liked to trace these so-called eccentricities through the "particular instances" mentioned in clause 8. But I must pass on to a subject of more pressing importance, viz. What after all was the matter with the well?

Now one of the strangest facts in connexion with this inquiry is, that the impurity of the well water was, in point of time, the very last discovery made by the investigators. We collected the evidence already described, not only in ignorance of the fact of the well having been contaminated, but in

the face of positive and seemingly reliable evidence to the contrary. The sides of the well had been examined, and declared, in a report made by order of the Paving Board on November 27th, 1854, "free from any fissures or other communication with drains or sewers by which such matters could possibly be conveyed into the waters." Both chemical and microscopical analysis had "failed to detect anything which could be pronounced peculiar to a cholera period, or capable of acting as a predisposing, co-operating, or specific agent in the production of that disease."

We stand exonerated, therefore, from the imputation of seeking to impugn the well-water, as accountable for the outbreak, on the ground of any previous knowledge of its impurity. Indeed, for my part, as I have sufficiently shown, I had a leaning the other way. And well I might have such a leaning, having myself drunk a little of this water, cold with brandy, on the evening of September 3d. On that day, we now see, it was less injurious than it had been; otherwise, as I found from other cases, brandy would not have neutralised the effects of the water when taken cold, though of course it diminished the quantity. In spite of my original bias, however, I went on collecting the evidence, until, at the very close of my inquiries, I accidentally lighted on a fact which led to further examination of the well, and to the excavation of the soil between the well and the nearest house.

From this examination there resulted the following disclosure. Old fashioned, flat-bottomed, its mortar-joints perishing, its brickwork decayed, the main drain from the house entered the sewer at the top instead of at the bottom, thereby dispensing with the usual fall, and facilitating the premature exit of fluid through its sieve-like sides. Congenial appendage to such a drain, a cesspool, intended for a trap, but misconstructed, was discovered in the front area, with other abominations, uncollected by water, which I forbear to recite. The cesspool, of course, rivalled the drain in the disreputable state of its brick-

work, the bricks admitting of being lifted from their beds without using the least force. The continuous passage of fluid through the sides of the cesspool being thus provided for, similar arrangements for its overflow presented themselves to the notice of the investigators, in the shape of a covering of saturated rotten boards. In close proximity both to drain and cesspool—its water-line but eight feet of vertical depth below the bottom level of the cesspool—two feet eight inches the horizontal distance between its outer brickwork and the drain—stood the Broad Street well. I need scarcely dilate upon the “washed” appearance of ground and gravel—“channelled furrows observable from” inside the well—black saturated “swampy soil”—in order to prove that the same policy which had long used the Thames for a sewer, had at least in one case made a cesspool of a well.

If I have said anything in this paper which appears to militate against the views of those who connect filth with cholera, I trust that I have now made amends, having furnished them with an additional argument for urging the disuse of the London surface wells, which from their very nature are, as our report alleged, “not only liable to “special contamination, but subject to “constant, unavoidable, and habitual “impurity.” And yet, strange to say, they are held in great repute. It is a fact that the Broad Street pump could boast a metropolitan reputation. It has been said, I know not with what truth, that its water was specially selected to sparkle in a once celebrated “nectar.” Its reputation is explained by Mr. Marshall as having been “partly due to “its low temperature, to the quantity of “carbonic acid contained in it, and to “the saline matter preventing its decomposition until after it had free “access to the air.”

It only remains that I should relate the circumstance which led to further examination of the well, and to the excavation of the surrounding soil.

There were, as I have stated, three cases of cholera in Broad Street before

the 31st of August, on the evening of which day the great outbreak began. In consequence of Dr. Snow's suggestions, I made particular inquiries respecting the two persons seized on August 12th and 30th. But both these cases had been in houses too far removed from the well to affect it otherwise than through the sewer, which, being a new sewer, seemed very unlikely to leak. As to the first cases on August 31st, they were so nearly simultaneous as to preclude the notion of their having been otherwise connected with each other than as having a common origin. But, singularly enough, I at first overlooked the case of August 28th; or, rather, I had recorded only the date of death, September 2d. I can only account for my not having inquired particularly into this case by the fact of its having been that of an infant; and I had not supposed that any one who died in Broad Street on the 2d of September had been ill for several days. One day, however, whilst searching a file of the Registrar's returns for another purpose, I came on the following entry:—

“At 40, Broad Street, 2d September, a daughter, aged five months: “exhaustion, after an attack of diarrhoea “*four days previous to death.*”

From my familiarity with the street, I knew that this was the house immediately facing the pump. So I hastened off at once to the house, and ascertained from the mother, who occupied the back parlour, that the child was attacked on August 28th, and that the dejections at first were abundant, but ceased on the 30th. In answer to further questions, she told me that the dejections were collected in napkins, which, on being removed, were immediately steeped in pails, the water from which was poured partly into a sink in the back yard, and partly into a cesspool in the front area.

Being struck with the dangerous proximity of this cesspool to the pump-well, I communicated the facts to the committee, who forthwith ordered an investigation to be made; with what result has already been described.

Now if this child's dejections did the mischief, it is easy to see, as they ceased on August 30th, how so shallow a well may have purified itself in a few days, especially as the cholera patients drank its water copiously, some of them at the rate of four gallons a day!

But it is not so easy to see why the mischief was not prolonged by further contamination of this water from subsequent cases in the same house. Certainly it may be suggested that the well may have killed off most of its habitual drinkers in the first few days of the outbreak, leaving only non-drinkers and those who were proof against its influence. But that is not a satisfactory hypothesis. A better explanation perhaps may be found in the fact of three of the subsequent cases having occurred in the upper back rooms, where there was a great temptation, in the confusion of the moment, to throw the evacuations out of the windows into the yard, which I ascertained was in one case actually done. And the fifth and

last case in this house, which was that of the father of the infant, occurred on September 8th, the very day on which the handle of the pump was removed.

Of course there arose considerable discussion among the doctors as to the precise nature of the child's illness, some contending that its diarrhoea was not choleraic; an opinion which is entitled to the more respect from its having been that of the doctor who attended the child. The committee, therefore, did not pledge themselves to the conclusion that the outbreak was due to this cause.

But this much, at any rate, may be affirmed, that, whatever uncertainty there may be about the nature of infantine diarrhoea, the plain fact of the child's dejections having been poured into a cesspool (the connexion between which and the pump-well is clearly established) for a period of three days immediately preceding a great outbreak, the phenomena of which point decidedly to the pump as its origin, is indeed a very remarkable coincidence.

CRADOCK NOWELL: A TALE OF THE NEW FOREST.

BY RICHARD DODDRIDGE BLACKMORE.

CHAPTER XXXI.

WHEN Miss Rosedew and her niece came in to get ready for dinner, Amy cried out suddenly, "Oh, only look at the roses, aunt; how they have opened to-day! What delicious Louise Odier, and just look at General Jacqueminot! and I do declare Jules Margottin is finer than he was at Midsummer. I must cut a few, for I know quite well there will come a great frost if I don't, and then where will all my loves be?"

Amy's prediction about the weather was as random a guess as we may find in great authorities, who are never right, although they give the winds sixteen points of the thirty-two to shuffle in. But it so turned out that the girl was right—a point of the compass never hit

till a day too late by our weather-clerks.

That very same night such a frost set in as had not been known in October for very nearly a century. It lasted nine nights and eight days; the mercury twice fell more than half-way from the freezing point to zero, and the grass was crisp in the shade all day, though the high sun wiped off the whiteness at noon wherever he found the way to it. Boys rejoiced, and went mitching, to slide on the pools of the open fuzery: no boys since the time of their great grandfathers had done the heel-tap in October. But the birds did not appreciate it. What in the world did it mean? Why, there were the hips not ripe yet, and the hollyberries come to no colour, and half the blackberries still too acid,

TIGHT GUTTERS

HERE

